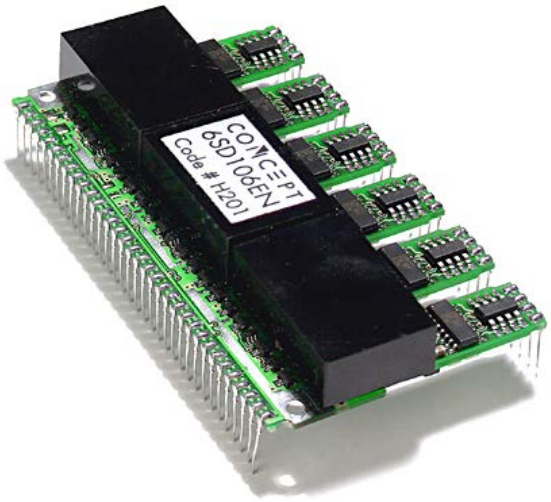
6SD106EI-17 Data Sheet

Six-pack SCALE Driver 6SD106EI-17

for IGBTs and Power MOSFETs

Description



The SCALE drivers from CONCEPT are based on a chip set that was developed specifically for the reliable driving and safe operation of IGBTs and power MOSFETs.

The name “SCALE” is an acronym for the most outstanding properties of the SCALE series of drivers:

SCALE = **S**caleable, **C**ompact, **A**ll purpose, **L**ow cost and **E**asy to use.

The SCALE driver is a winning project of the competition organized by “Technology Center Switzerland 1998”. And ABB Switzerland AG honored the development of the SCALE driver by distinguishing it as the “best power electronics project in 1998”.

Product Highlights

- Partial discharge tested for 1700V applications
- Short circuit and overcurrent protection
- Extremely reliable, long service life
- High gate current of ±6A
- Electrical isolation of 4000V_{AC}
- Electrically isolated status acknowledgement
- Monitoring of power supply and self-monitoring
- Switching frequency DC to >100kHz
- Duty cycle: 0... 100%
- High dv/dt immunity, guaranteed >100,000V/µs
- Complete with DC/DC converter

Applications

- Inverters
- Motor drive technology
- Traction
- Railroad power supplies
- Converters
- Power engineering
- Switched-mode power supplies
- Radiology and laser technology
- DC/DC converter
- Research
- RF generators and converters

Block Diagram

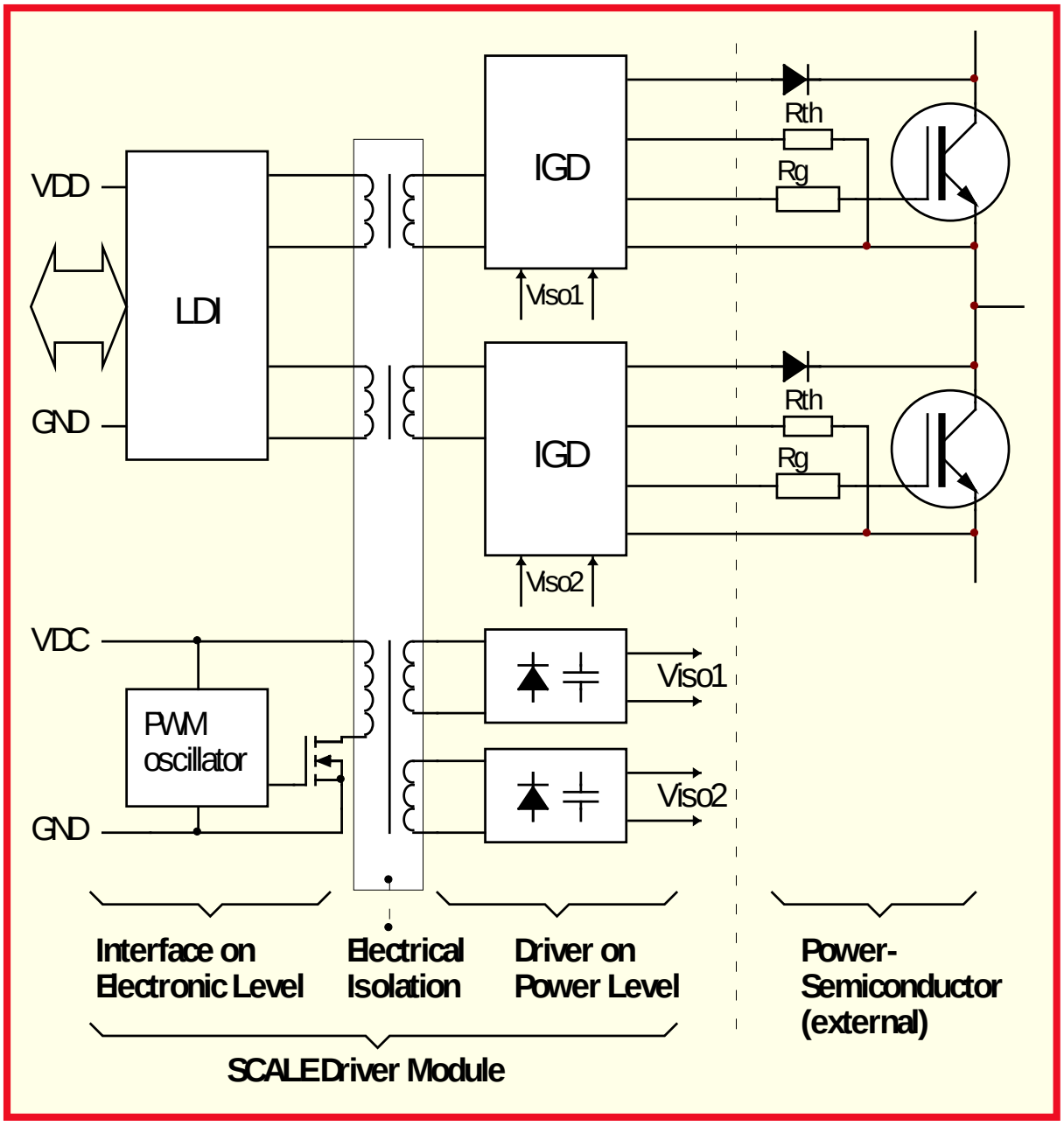


Fig. 1 Block diagram shows 2 channels (i.e. one third) of the 6SD106EI-17

The block diagram shows two channels (i.e. one third) of the 6SD106EI-17 six-pack driver. There is only one PWM oscillator, whereas all other components are present in triplicate.

Pin Designation

Pin	Des.	Function	Pin	Des.	Function
1	GND	Ground of the power supply	68	U_C2	Phase U, Collector sense ch. 2
2	U_SO2	Phase U, Status output channel 2	67	U_Rth2	Phase U, Reference resistor ch. 2
3	U_Mod	Phase U, Mode input	66	U_E2	Phase U, Emitter channel 2
4	U_RC2	Phase U, RC network channel 2	65	U_G2	Phase U, Gate channel 2
5	U_InB	Phase U, Input B	64		Free
6	U_InA	Phase U, Input A	63		Free
7	U_RC1	Phase U, RC network channel 1	62	U_C1	Phase U, Collector sense ch. 1
8	U_VL	Phase U, Logic level/Reset	61	U_Rth1	Phase U, Reference resistor ch. 1
9	U_SO1	Phase U, Status output channel 1	60	U_E1	Phase U, Emitter channel 1
10	GND	Ground of DC/DC converter	59	U_G1	Phase U, Gate channel 1
11	GND	Ground of DC/DC converter	58		Free
12	VDC	+15V for DC/DC converter	57		Free
13	VDC	+15V for DC/DC converter	56	V_C2	Phase V, Collector sense ch. 2
14	V_SO2	Phase V, Status output channel 2	55	V_Rth2	Phase V, Reference resistor ch. 2
15	V_Mod	Phase V, Mode input	54	V_E2	Phase V, Emitter channel 2
16	V_RC2	Phase V, RC network channel 1	53	V_G2	Phase V, Gate channel 2
17	V_InB	Phase V, Input B	52		Free
18	V_InA	Phase V, Input A	51		Free
19	V_RC1	Phase V, RC network channel 1	50	V_C1	Phase V, Collector sense ch. 1
20	V_VL	Phase V, Logic level/Reset	49	V_Rth1	Phase V, Reference resistor ch. 1
21	V_SO1	Phase V, Status output channel 1	48	V_E1	Phase V, Emitter channel 1
22	GND	Ground of the power supply	47	V_G1	Phase V, Gate channel 1
23	GND	Ground of the power supply	46		Free
24	VDD	+15V for electronic input side	45		Free
25	VDD	+15V for electronic input side	44	W_C2	Phase W, Collector sense ch. 2
26	W_SO2	Phase W, Status output channel 2	43	W_Rth2	Phase W, Reference resistor ch. 2
27	W_Mod	Phase W, Mode input	42	W_E2	Phase W, Emitter channel 2
28	W_RC2	Phase W, RC network channel 2	41	W_G2	Phase W, Gate channel 2
29	W_InB	Phase W, Input B	40		Free
30	W_InA	Phase W, Input A	39		Free
31	W_RC1	Phase W, RC network channel 1	38	W_C1	Phase W, Collector sense ch. 1
32	W_VL	Phase W, Logic level/Reset	37	W_Rth1	Phase W, Reference resistor ch. 1
33	W_SO1	Phase W, Status output channel 1	36	W_E1	Phase W, Emitter channel 1
34	GND	Ground of the power supply	35	W_G1	Phase W, Gate channel 1

Legend:

Pins with the designation “Free” are not physically present

Mechanical Dimensions

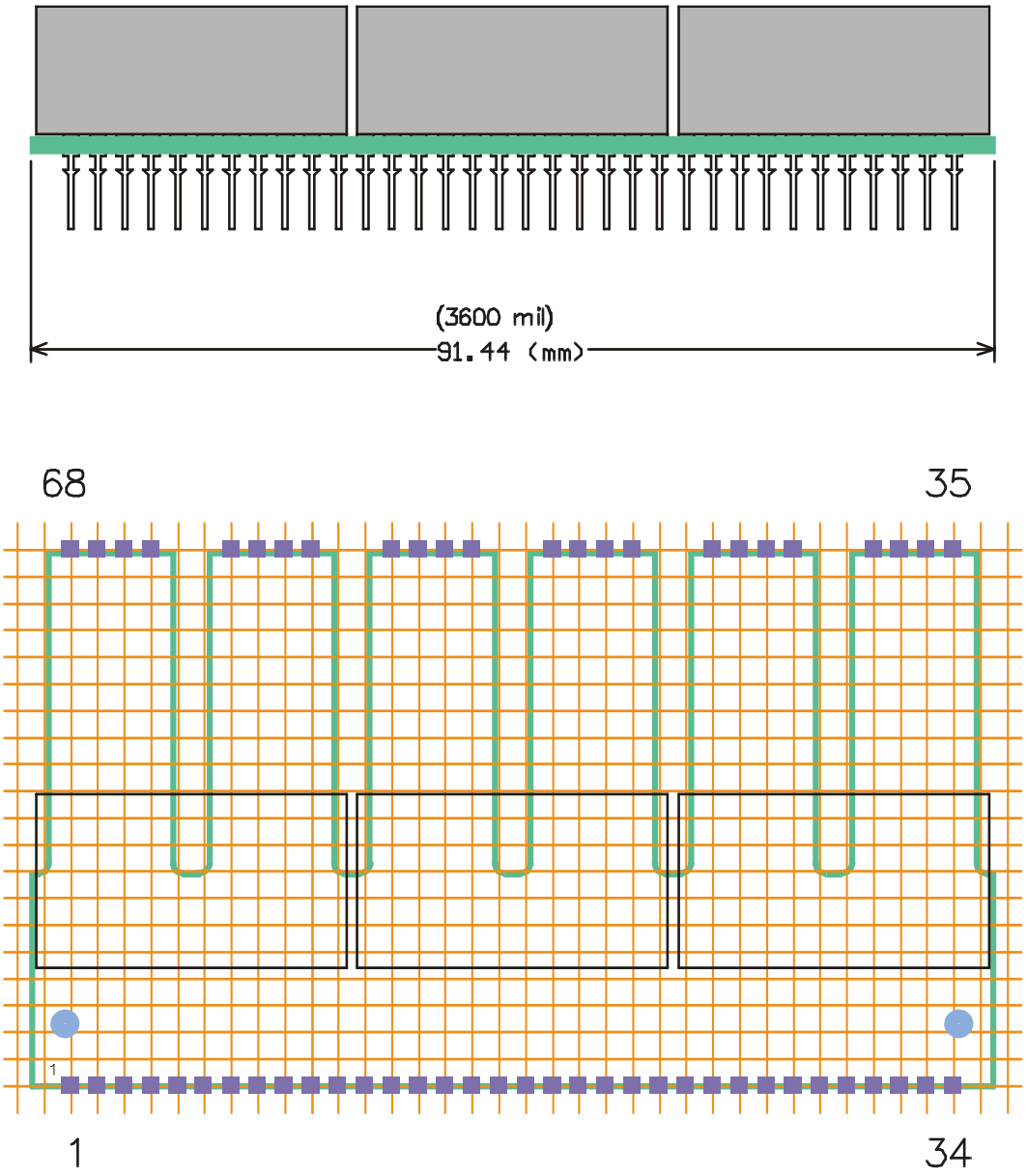


Fig. 2 Front view (top) / Layout overview component side (bottom) 6SD106EI-17

Grid of the aspect drawing on page 4 below: 2.54mm (100mil)

Recommended diameter of solder pad: Ø 1.6mm; diameter of drill holes: Ø 1.0mm

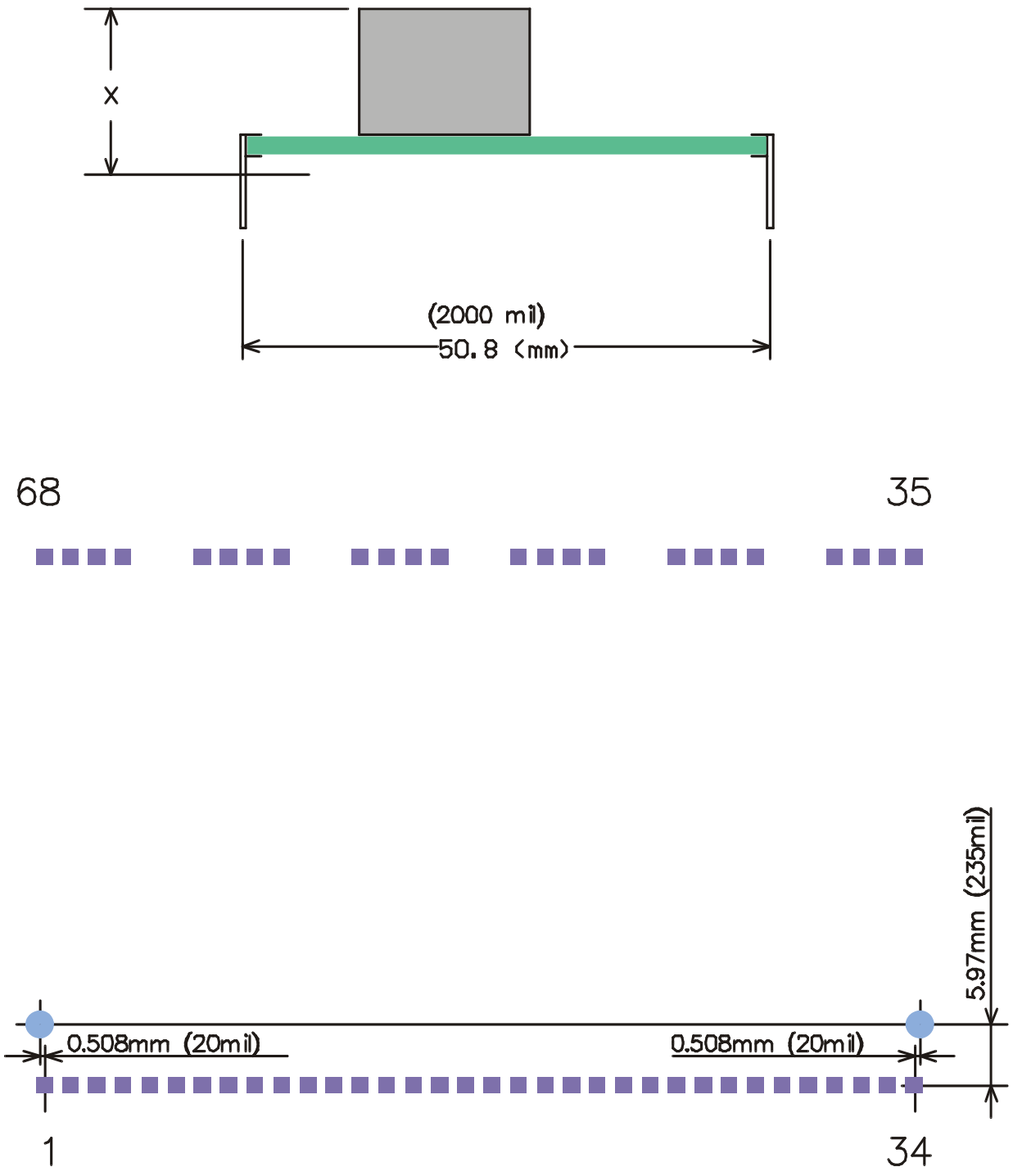


Fig. 3 Side view (top) / Mechanical fixing (bottom) 6SD106EI-17

Height X: typ. 16mm

Mechanical fixing

The 6SD106EI-17 driver has two holes each 2.7mm in diameter. They allow additional fixing of the driver for applications requiring very high resistance to shaking/vibration (railways, traction systems, electrically-driven vehicles, etc.). See Fig. 3 (bottom).

Absolute Maximum Ratings

Parameter	Test conditions	min	max	unit
Supply voltage *VDC*		0	16	Vdc
Supply voltage *VDD*		0	16	Vdc
Logic input voltage	to GND	0	*VDD*	Vdc
Gate peak current I_{out}	Gx to Ex	-6	+6	A
Output power DC/DC converter	total for 6 channels		6	W
Operating voltage	continuous (see Note 8)		1200	Vdc
Test voltage (50Hz/1min)	inputs to outputs		4000	V_{AC}(eff)
Operating temperature	(see Note 10)	-40	+85	°C
Storage temperature		-40	+90	°C

All data refer to +25°C and *VDD* = *VDC* = 15V unless otherwise specified

Electrical Characteristics

Power supply	Test conditions	min	typ	max	unit
Nominal supply voltage *VDC*	to GND (see Note 1)		15		Vdc
Supply current *IDC*	without load		70		mA
Max. supply current *IDC*	(see Note 2)			460	mA
Output power DC/DC converter	(see Note 3)			6	W
Efficiency η	internal DC/DC converter		85		%
Nominal supply voltage *VDD*	to GND		15		Vdc
Supply current *IDD*	without load		35		mA
Supply current *IDD*	at 25kHz switching frequency		44		mA

Electrical Characteristics (Continuation)

Power supply monitoring	**Test conditions**	**min**	**typ**	**max**	**unit**
Turn-on threshold V_{th}	(see Note 4)		11.5		Vdc
Hysteresis on-/off	(see Note 4)		0.7		Vdc
Logic inputs	**Test conditions**	**min**	**typ**	**max**	**unit**
Input voltage	all inputs (see Note 5)	0		*VDD*	Vdc
Timing characteristics	**Test conditions**	**min**	**typ**	**max**	**unit**
Delay time input to output	turn-on $t_{pd(on)}$		300		ns
	turn-off $t_{pd(off)}$		350		ns
Blocking time	after failure (see Note 12)		1		s
Outputs	**Test conditions**	**min**	**typ**	**max**	**unit**
Output current *IG*	Gx to Ex (see Note 6)	-6		+6	A
Output rise time $t_{r(out)}$	Gx to Ex (see Note 7)		100		ns
Output fall time $t_{f(out)}$	Gx to Ex (see Note 7)		80		ns
Output current SOx		1.5			mA
Output voltage rating SOx	SOx to GND			*VDD*	V
Vce-Monitoring	**Test conditions**	**min**	**typ**	**max**	**unit**
Inputs Cx	to Ex	0		*VDD*	Vdc
Electrical isolation	**Test conditions**	**min**	**typ**	**max**	**unit**
Operating voltage	continuous (see Note 8)			1200	Vdc
Test voltage	(50Hz/1min) (see Note 11)			4000	$V_{AC(eff)}$
Partial discharge extinction volt.	IEC270	>1700			$V_{AC(pk)}$
Creep path input-output			12.7		mm
Creep path output-output			12.7		mm
Maximum $\Delta V/\Delta t$ at ΔV =1000V	(see Note 9)	100			kV/µs

All data refer to +25°C and *VDD* = *VDC* = 15V unless otherwise specified

Operating conditions

Operating conditions	Test conditions	min	max	unit
Operating temperature	(see Note 10)	-40	+85	°C
Storage temperature		-40	+90	°C

Footnotes to the key data

1) The drivers have a zener diode on each channel for over-voltage protection. When the feed voltage exceeds 16V, this protection can be subject to thermal overload.
2) If the specified power consumption is exceeded, this indicates an overload of the DC/DC converter. It should be noted that these DC/DC converters are not protected against overload.
3) This should be considered as a recommended value. Please consult the section: “Output power and self-heating”.
4) Under-voltage monitoring for protecting the power semiconductors. The voltage refers to the local supply voltage of each individual drive channel. However, this corresponds approximately to the voltage at VDC with respect to GND.
5) The input levels must never exceed the limits of the supply voltage (i.e. between GND and VDD), otherwise latch-up of the integrated circuits LDI 00I can occur. Particular care must be taken when driving via cables or longer leads.
6) The gate current must be limited to its maximum value by a gate resistor.
7) At a load of 39nF in series with 5.6 Ω (typical load of a 1200V/100A IGBT).
8) Maximum continuous or repeatedly-applied DC voltage between all inputs and all outputs.
9) This specification guarantees that the drive information will be transferred reliably even at a high DC-link voltage and fastest switching operations.
10) The application-specific self-heating of the drivers - specially at high load - must be taken into account.
11) The test voltage of 4000 Vac(rms)/50Hz may be applied only once during a minute. It should be noted that with this (strictly speaking obsolete) test method, some (minor) damage occurs to the isolation layers due to the partial discharge. Consequently, this test is not performed at CONCEPT as a series test. In the case of repeated isolation tests (e.g. module test, equipment test, system test) the subsequent tests should be performed with a lower test voltage: the test voltage is reduced by 400V for each additional test. The more modern if more elaborate partial-discharge measurement is better suited than such test methods as it is almost entirely non-destructive.
12) The typical blocking time after an error is 1 second. If required, versions with other blocking times may also be supplied.

Application Hints

IMPORTANT INFORMATION

This data sheet contains only product-specific data. All data that apply to the whole type series of SCALE drivers is given in the document entitled: “Description and Application Manual for SCALE Drivers”. In particular, this manual contains a detailed description of the concept of the SCALE drivers, a description of the function of all terminal pins as well as other important application hints.

Overview and application

The SCALE driver 6SD106EI-17 is a six-pack driver for power MOSFETs and IGBTs.

The terminal pins of the 6SD106EI-17 driver are arranged so that the layout can be kept very simple and the logic signal flow (input signal ⇒ drive circuit ⇒ power transistors) is maintained. A distance of 12.7mm is observed between the drive signal and the power potential!

Collector sense and dimensioning of Rth

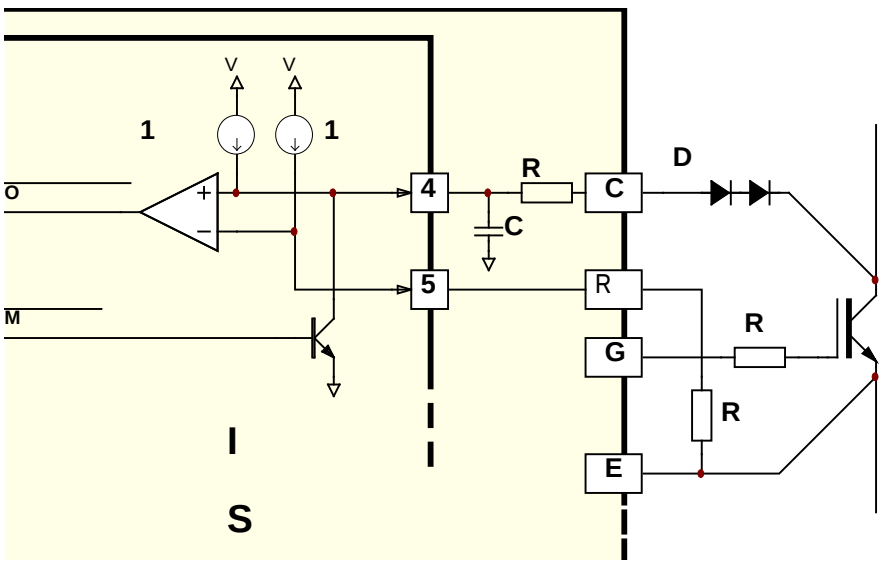


Fig. 4 Collector-sense circuit principle

The 6SD106EI-17 six-pack driver has a collector-sense circuit to protect the power semiconductors. It is shown in Fig. 4

Its basic operating mode can be obtained from the brochure entitled: “Description and Application Manual for Scale Drivers”.

To correspond more effectively to the turn-on characteristic

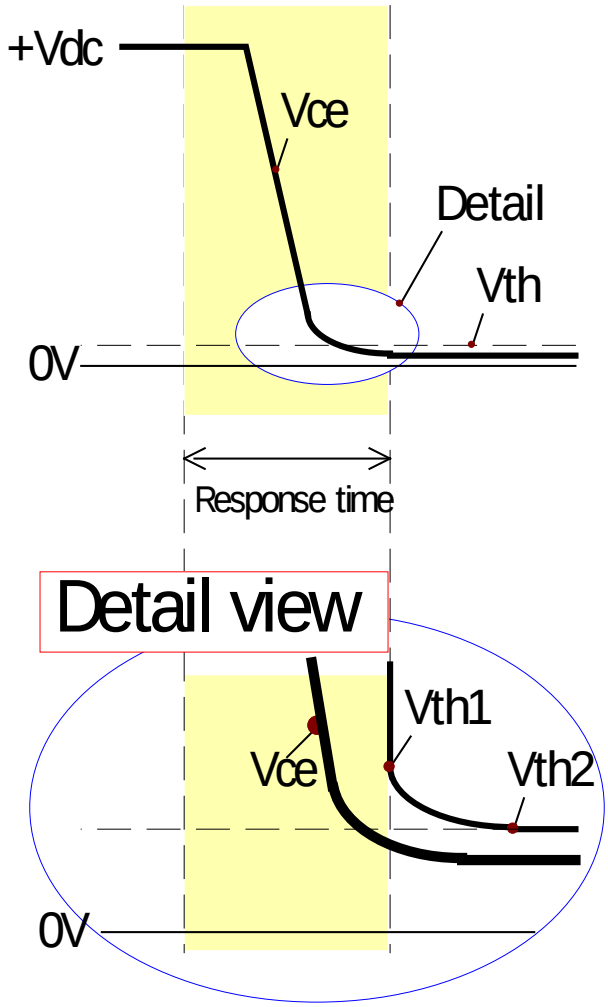


Fig. 5 Collector-sense voltage curve

of the IGBTs, the SCALE drivers do not use a static reference voltage to compare the voltage at the collector. Instead, the reference is used as shown in Fig. 5.

Notes on Table 1

The values for "Vth1" and "Vth2" are listed in **Table 1** as a function of the reference resistance Rth.

The value in the "Vth1" column corresponds to the voltage threshold after the response time has elapsed.

The value in the "Vth2" column corresponds to the voltage which is set up statically across the resistor Rth. This static value is typically reached after between 10 and 15 µs.

The value in the "V_{CE}(off)" column corresponds to the collector-emitter voltage value at which the protection function is activated when the external circuit is used as shown in Fig. 4 with one or two Dm diodes of type 1N4007 connected in series.

Value Rth	Reaction time	Vth1	Vth2	V_{CE}(off)
22k	≈ 4.9µs	≈ 4.8V	≈ 3.2V	2.35V (1 Diode)
27k	≈ 5.7µs	≈ 5.6V	≈ 3.9V	3.05V (1 Diode)
33k	≈ 6.8µs	≈ 6.5V	≈ 4.7V	3.25V (2 Diodes)
39k	≈ 7.6µs	≈ 7.3V	≈ 5.6V	4.15V (2 Diodes)
47k	≈ 9µs	≈ 8.4V	≈ 6.8V	5.35V (2 Diodes)

Table 1 Reference resistor, reaction time and turn-off threshold

Output power and self-heating

The specified output power of the driver totals 6W (1W per channel). This typically suffices to drive a 100A/1200V six-pack IGBT module with 25kHz. In the case of a drive power of 6W, the typical input power of the driver is about 7W; the losses due to the driver total about 1W. Because CONCEPT cannot predict how the drivers will be incorporated in the user's application, no binding recommended value for self-heating and thus for the maximum useful output power at high ambient temperatures can be made. It is consequently recommended to check the self-heating of the system, especially when it is used at higher temperatures.

For the calculation of the exact output power, reference should be made to Application Note AN-9701 "IGBT drivers correctly calculated" on www.igbt-driver.com/go/app-note.

If you need any help, simply call our technical support

CONCEPT provides expert help with your questions and problems:

www.IGBT-Driver.com/go/support

Quite special: customized SCALE drivers

If you need a power MOSFET or IGBT driver that is not included in the delivery range, don't hesitate to contact CONCEPT or your CONCEPT sales partner.

CONCEPT engineers have more than 20 years experience in the development and manufacture of intelligent drivers for power MOSFETs and IGBTs and have already implemented a large number of customized solutions.

Important Notice

The data contained in this product data sheet is intended exclusively for technically trained staff. Handling all high-voltage equipment involves risk to life. Strict compliance with the respective safety regulations is mandatory!

Any handling of electronic devices is subject to the general specifications for protecting electrostatic-sensitive devices according to international standard IEC 747-1, Chapter IX or European standard EN 100015 (i.e. the workplace, tools, etc. must comply with these standards). Otherwise, this product may be damaged.

Legal Disclaimer

This data sheet specifies devices but cannot promise to deliver any specific characteristics. No warranty or guarantee is given – either expressly or implicitly – regarding delivery, performance or suitability.

CT-Concept Technologie AG reserves the right to make modifications to its technical data and product specifications at any time without prior notice. The general terms and conditions of delivery of CT-Concept Technologie AG apply.

Ordering Information

Six-pack SCALE driver with ±6A gate current / ±15V gate voltage

6SD106EI-17

Information about Other Products

For other drivers, product documentation, and application support

Direct link: Please click: www.IGBT-Driver.com

Manufacturer

CT-Concept Technologie AG
Intelligent Power Electronics
Renferstrasse 15
CH-2504 Biel-Bienne
Switzerland

Tel. +41 - 32 - 344 47 47
Fax +41 - 32 - 344 47 40

E-mail Info@IGBT-Driver.com
Internet www.IGBT-Driver.com

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